

is connected to the internal bus 1027, and a display card 1300 and other cards are connected to the general purpose bus-1 1029, such that the display card 1300 and others connected to the general purpose bus-1 1029 will not be affected by the AAL frame transfer between the ATM NIC and another ATM NIC or non-virtual connection oriented NIC. In this expanded configuration of FIG. 18, the AAL frame to be transferred between the ATM NIC and another ATM NIC or non-virtual connection oriented NIC will be transferred only within the general purpose bus-2 1031, and not passed to the general purpose bus-1 1029 by means of the bridge 1200, so that it is possible to reduce the influence due to the AAL transfer on elements such as the CPU 1100 and the display card 1300 which are connected to buses other than the general purpose bus-2 1031.

As described, according to the present invention, it is possible to improve the transfer efficiency of the router device by determining the information for the transfer control and/or priority control (the network interface which is the transfer target of the datagram or AAL frame, and/or the quality of service of the datagram) from the virtual connection identifier of the entered datagram or the assembled AAL frame, without looking into the datagram content.

In the router device of the first embodiment, the network interface that is the transfer target of the datagram can be determined by referring to a table according to the identifier of the virtual connection from which the datagram is entered, without looking into the datagram content, and the datagram can be transferred to the determined network interface. Here, the router device may include means for applying the network layer processing to the datagram according to the protocol of the network.

This means for applying the network layer processing to the datagram is preferably provided for each network interface. This is because the entered datagrams can be distributed to the output interfaces at high speed according to the identifiers of the virtual connections, and the network layer processings can be applied in parallel at the output interfaces.

Also, in the router device of the second embodiment, the quality of service of the datagram can be determined by referring to a table according to the identifier of the virtual connection from which the datagram is entered, without looking into the datagram content, and the priority control for the datagrams can be carried out according to the determined quality of service.

Also, in the router device of the third embodiment, the network interface that is the transfer target of the datagram and the quality of service of the datagram can be determined by referring to a table according to the identifier of the virtual connection from which the datagram is entered, without looking into the datagram content, and the datagram can be transferred to the determined network interface while carrying out the priority control for the datagrams according to the determined quality of service.

By obtaining the information from the virtual connection identifier before referring to the datagram itself in this manner, the work required for the router device can be reduced and the transfer efficiency of the router device can be improved.

Note that the priority control may be carried out at a stage immediately before the network layer processing according to the protocol of the network is applied, or at a stage immediately before the datagram is outputted to the output side network interface. It is also possible to carry out the priority control at a stage immediately before the datagram

analysis to determine the transfer target network interface from the datagram content.

Also, in the router device of the fourth embodiment, the network interface that is the transfer target of the AAL frame and the output virtual connection identifier can be determined by referring to a table according to the identifier of the virtual connection from which the AAL frame is entered, without assembling the datagram from the AAL frame that is assembled at the reception unit and looking into the datagram content, and the AAL frame can be transmitted to the virtual connection having the determined output virtual connection identifier by the transmission unit of the determined network interface. Here, the notification of the determined output virtual connection identifier to the transmission unit and the transfer of the AAL frame to the transmission unit can be done in any desired order.

In this router device of the fourth embodiment, by obtaining the information from the virtual connection identifier without referring to the datagram itself, the transfer efficiency of the router device can be improved. In addition, because of the use of the AAL frame assembling, it is possible to prevent a transfer of those ATM cells which cannot be assembled into the AAL frame because of cell loss or some other causes, so that the utilization efficiency of the transmission channel can be increased.

Also, when AALS is used, if the ATM cells received from a plurality of input connections are merged and transmitted to the output connection, it is impossible to assemble the AAL frame at the final destination in a case of the ATM cell transfer. However, by using the AAL transfer, the AAL frames received from a plurality of input connections can be merged and transmitted to the output connection, so that it becomes easier to deal with the multicast.

Note that the transmission unit and the reception unit in this fourth embodiment can be provided in forms of network interface cards.

It is to be noted that, in the fourth embodiment described above, the connection management table of the connection identifier analysis unit is used for determining an output interface to which the datagram is to be transferred, but it is also possible to use the connection management table of the connection identifier analysis unit for determining an output virtual connection identifier corresponding to an input connection identifier, and transfer the datagram such that the datagram is outputted to a virtual connection having a virtual connection identifier identical to the determined output virtual connection identifier, in the similar manner as described above.

It is also to be noted that, besides those already mentioned above, many modifications and variations of the above embodiments may be made without departing from the novel and advantageous features of the present invention. Accordingly, all such modifications and variations are intended to be included within the scope of the appended claims.

What is claimed is:

[1. A router device for transferring datagrams among networks comprising:
network interfaces connected with
networks including at least one virtual
connection oriented network;

a memory for storing a correspondence
between a virtual connection identifier and a
transfer target network interface;

31

connection identifier analysis means for determining a transfer target network interface for a datagram entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection; and

transfer means for transferring the datagram to the transfer target network interface determined by the connection identifier analysis means.

2. The router device of claim 1, further comprising reception means for receiving a datalink frame from the virtual connection and assembling the datalink frame into the datagram.

3. The router device of claim 1, wherein the memory also stores a correspondence between a virtual connection identifier and an output virtual connection identifier to be used in a case where a network connected with the transfer target network interface is a virtual connection oriented network.

4. The router device of claim 3, wherein the connection identifier analysis means also notifies an output virtual connection identifier for the datagram to the transfer target network interface.]

5. (Amended) A [The] router device [of claim 1] for transferring datagrams among networks comprising:

network interfaces connected with networks including at least one virtual connection oriented network;

a memory configured to store a correspondence between a virtual connection identifier and a transfer target network interface;

a connection identifier analysis unit configured to determine a transfer target network interface for a datagram entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection; and

a transfer unit configured to transfer the datagram to the transfer target network interface determined by the connection identifier analysis unit.

wherein the memory also stores a correspondence between [a] the virtual connection identifier and a next hop network layer address to be used in a case where network connected with the transfer target network interface is a non-virtual connection oriented network.

6. The router device of claim 5, wherein the connection identifier analysis unit [means] also notifies a next hop network layer address for the datagram to the transfer target network interface.

32

7. (Amended) A [The] router device [of claim 1, further comprising:] for transferring datagrams among networks comprising:

network interfaces connected with networks including at least one virtual connection oriented network;

a memory configured to store a correspondence between a virtual connection identifier and a transfer target network interface;

a connection identifier analysis unit configured to determine a transfer target network interface for a datagram entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection;

a transfer unit configured to transfer the datagram to the transfer target network interface determined by the connection identifier analysis unit; and

a datagram analysis unit configured to register [means for registering] in advance a correspondence between a datagram content and a transfer target network interface, and to determine [determining] a transfer target network interface for the datagram according to a datagram content of the datagram when the memory does not store the transfer target network interface in correspondence to the virtual connection identifier of the virtual connection[;].

wherein the transfer unit [means] transfers the datagram to the transfer target network interface determined by the datagram analysis unit [means] when the memory does not store the transfer target network interface in correspondence to the virtual connection identifier of the virtual connection.

8. (Amended) A [The] router device [of claim 1] for transferring datagrams among networks comprising:

network interfaces connected with networks including at least one virtual connection oriented network;

a memory configured to store a correspondence between a virtual connection identifier and a transfer target network interface;

a connection identifier analysis unit configured to determine a transfer target network interface for a datagram entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection; and

a transfer unit configured to transfer the datagram to the transfer target network interface determined by the connection identifier analysis unit, wherein:

33

the memory also stores a correspondence between a virtual connection identifier and a quality of service;

the connection identifier analysis unit [means] also determines a quality of service for the datagram by referring to the memory according to a virtual connection identifier of the virtual connection; and

the router device further comprises:

a scheduler configured to apply [means for applying] a priority control for datagrams to be transferred by the router device according to the quality of service determined by the connection identifier analysis unit [means], such that the transfer unit [means] transfers the datagram to which the priority control is applied by the scheduler [means].

9. The router device of claim 8, further comprising:

a datagram analysis unit configured to register [means for registering] in advance a correspondence between a datagram content and a transfer target network interface, and to determine [determining] a transfer target network interface for the datagram to which the priority control is applied by the scheduler [means] according to a datagram content of the datagram;

wherein the scheduler [means] makes the priority control of orders in which datagrams are given to the datagram analysis unit [means].

10. (Amended) The router device of claim 8, further comprising:

a processor configured to determine [processing means for determining] a transfer target network interface and/or next hop network layer address and to apply [ing] a network layer processing for the datagram to be transferred by the router device[;],

wherein the scheduler [means] makes the priority control of orders in which datagrams are given to the processing unit [means].

[11. The router device of claim 1, further comprising

datagram processing means for applying a network layer processing to the datagram to be transferred by the router device.]

12. (Amended) A [The] router device [of claim 11] for transferring

datagrams among networks comprising:
network interfaces connected with
networks including at least one virtual
connection oriented network;

a memory configured to store a
correspondence between a virtual connection
identifier and a transfer target network
interface;

a connection identifier analysis unit
configured to determine a transfer target

34

network interface for a datagram entered from
a virtual connection, by referring to the
memory according to a virtual connection
identifier of the virtual connection;

a transfer unit configured to transfer the
datagram to the transfer target network
interface determined by the connection
identifier analysis unit; and

a datagram processing unit configured to
apply network layer processing to the
datagram to be transferred by the router device,
wherein the datagram processing unit [means] is separately provided for each network interface.

[13. A router device for transferring datagrams among networks, comprising:

at least one network interface connected with at least one virtual connection oriented network;

a memory for storing a correspondence between a virtual connection identifier and an output virtual connection identifier;

connection identifier analysis means for determining an output virtual connection identifier for a datagram entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection; and

transfer means for transferring the datagram such that the datagram is outputted to a virtual connection having the output virtual connection identifier determined by the connection identifier analysis means.

14. The router device of claim 13, further comprising reception means for receiving a datalink frame from the virtual connection and assembling the datalink frame into the datagram.]

15. A router device for transferring datagrams among networks, comprising:

at least one network interface connected with at least one virtual connection oriented network;

a memory configured to store [for storing] a correspondence between a virtual connection identifier and a quality of service;

a connection identifier analysis unit configured to determine [means for determining] a quality of service for a datagram entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection;

a scheduler configured to apply [means for applying] a priority control for datagrams to be transferred by the router device according to the quality of service determined by the connection identifier analysis unit [means]; and

35

a transfer unit configured to transfer [means for transferring] the datagram to which the priority control is applied by the scheduler [means].

16. (Amended) The router device of claim 15, further comprising:

a datagram analysis unit configured to register [means for registering] in advance a correspondence between a datagram content and a transfer target network interface, and to determine [determining] a transfer target network interface for the datagram to which the priority control is applied by the scheduler [means] according to a datagram content of the datagram[;],

wherein the scheduler [means] makes the priority control of orders in which datagrams are given to the datagram analysis unit [means].

17. (Amended) The router device of claim 15, further comprising:

a processor configured to determine [processing means for determining] a transfer target network interface and/or next hop network layer address and to apply[ing a] network layer processing for the datagram to be transferred by the router device[;],

wherein the scheduler [means] makes the priority control of orders in which datagrams are given to the processor [processing means].

[18. A router device for transferring AAL frames from an ATM network through network interfaces connected with networks including at least one ATM network, each network interface connected with said at least one ATM network including reception means for receiving ATM cells from an ATM network and assembling an AAL frame from the received ATM cells, and transmission means for forming ATM cells from an AAL frame and transmitting the formed ATM cells to an ATM network, the router device comprising:

a memory for storing a correspondence between a virtual connection identifier and a transfer target network interface;

connection identifier analysis means for determining a transfer target network interface for an AAL frame assembled from ATM cells entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection;

processing means for determining a transfer target network interface for the AAL frame by assembling datagram from the AAL frame and analyzing the assembled datagram, when the memory does not store the transfer target network interface in correspondence to the virtual connection identifier of the virtual connection; and

36

transfer means for transferring the AAL frame to the transfer target network interface determined by one of the connection identifier analysis means and the processing means.]

[19. An ATM network interface card device for interfacing an ATM network and a bus for connecting other network interfaces connected with other networks, the ATM network interface card device comprising:

reception means for receiving ATM cells from the ATM network and assembling an AAL frame from the received ATM cells;

a memory for storing a correspondence between a virtual connection identifier and a transfer target network interface;

connection identifier analysis means for determining a transfer target network interface for an AAL frame assembled from ATM cells entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection; and

transfer means for transferring the AAL frame through the bus to the transfer target network interface determined by the connection identifier analysis means.]

20. A router device for transferring datagrams among networks, comprising:

at least one network interface connected with at least one virtual connection oriented network;

a memory configured to store [for storing] a correspondence between a virtual connection identifier and a protocol type information indicating a type and/or a version of a protocol;

a connection identifier analysis unit configured to determine [means for determining] a protocol type information for a datagram entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection;

a datagram analysis unit configured to determine [means for determining] a transfer target network interface/next hop network layer address for the datagram according to a datagram content of the datagram, the datagram analysis unit [means] having a plurality of processors in correspondence to different protocols, and the datagram is entered into one of said plurality of processors which corresponds to a protocol of a type and/or a version indicated by the protocol type information determined by the connection identifier analysis unit [means]; and

a transfer unit configured to determine [means for transferring] the datagram to the transfer target network interface/next hop

37

network layer address determined by the datagram analysis unit [means].

[21. A method for transferring datagrams among networks, using a router device having network interfaces connected with networks including at least one virtual connection oriented network, the method comprising the steps of:

storing a correspondence between a virtual connection identifier and a transfer target network interface in a memory provided at the router device;

determining a transfer target network interface for a datagram entered from a virtual connection at the router device, by referring to the memory according to a virtual connection identifier of the virtual connection; and

transferring the datagram to the transfer target network interface determined by the determining step.

22. A method for transferring datagrams among networks, using a router device having at least one network interface connected with at least one virtual connection oriented network, the method comprising the steps of:

storing a correspondence between a virtual connection identifier and an output virtual connection identifier in a memory provided at the router device;

determining an output virtual connection identifier for a datagram entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection; and

transferring the datagram such that the datagram is outputted to a virtual connection having the output virtual connection identifier determined by the determining step.]

23. A method for transferring datagrams among networks, using a router device having at least one network interface connected with at least one virtual connection oriented network, the method comprising the steps of:

storing a correspondence between a virtual connection identifier and a quality of service in a memory provided at the router device;

determining a quality of service for a datagram entered from a virtual connection at the router device, by referring to the memory according to a virtual connection identifier of the virtual connection;

applying a priority control for datagrams to be transferred by the router device according to the quality of service determined by the determining step; and

transferring the datagram to which the priority control is applied by the applying step.

[24. A method for transferring AAL frames from an ATM network, using a router

38

device having network interfaces connected with networks including at least one ATM network, each network interface connected with said at least one ATM network including reception means for receiving ATM cells from an ATM network and assembling an AAL frame from the received ATM cells, and transmission means for forming ATM cells from an AAL frame and transmitting the formed ATM cells to an ATM network, the method comprising the steps of:

storing a correspondence between a virtual connection identifier and a transfer target network interface in a memory provided at the router device;

determining a transfer target network interface for an AAL frame assembled from ATM cells entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection;

processing the AAL frame to determine a transfer target network interface for the AAL frame by assembling datagram from the AAL frame and analyzing the assembled datagram, when the memory does not store the transfer target network interface in correspondence to the virtual connection identifier of the virtual connection; and

transferring the AAL frame to the transfer target network interface determined by one of the determining step and the processing step.

25. A method for interfacing an ATM network and a bus for connecting other network interfaces connected with other networks, the method comprising the steps of: receiving ATM cells from the ATM network and assembling an AAL frame from the received ATM cells;

storing a correspondence between a virtual connection identifier and a transfer target network interface in a memory;

determining a transfer target network interface for an AAL frame assembled from ATM cells entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection; and

transferring the AAL frame through the bus to the transfer target network interface determined by the determining step.]

26. A method for transferring datagrams among networks, using a router device having at least one network interface connected with at least one virtual connection oriented network, the method comprising the steps of:

storing a correspondence between a virtual connection identifier and a protocol type information indicating a type and/or a version

39

of a protocol in a memory provided at the router device;

determining a protocol type information for a datagram entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection;

determining a transfer target network interface/next hop network layer address for the datagram according to a datagram content of the datagram, wherein a plurality of processors are provided at the router device in correspondence to different protocols, and the datagram is entered into one of said plurality of processors which corresponds to a protocol of a type and/or a version indicated by the protocol type information determined by the determining step; and

transferring the datagram to the determined transfer target network interface/next hop network layer address.

[27. A data communication network system, comprising:

networks including at least one virtual connection oriented network;

a transmission node provided in each network for transmitting datagrams such that datagrams destined to an identical destination are transmitted through at least one specific virtual connection; and

a router device for connecting at least two of the networks, the router device including:

network interfaces connected with said at least two of the networks;

a memory for storing correspondence between a virtual connection identifier and a transfer target network interface;

connection identifier analysis means for determining a transfer target network interface for a datagram entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection; and

transfer means for transferring the datagram to the transfer target network interface determined by the connection identifier analysis means.

28. A data communication network system comprising:

networks including at least one virtual connection oriented network;

a transmission node provided in each network for transmitting datagrams such that datagrams destined to an identical destination are transmitted through at least one specific virtual connection; and

a router device for connecting at least two of the networks, the router device including:

40

at least one network interface connected with said at least two of the networks;

a memory for storing a correspondence between a virtual connection identifier and an output virtual connection identifier;

connection identifier analysis means for determining an output virtual connection identifier for a datagram entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection; and

transfer means for transferring the datagram such that the datagram is outputted to a virtual connection having the output virtual connection identifier determined by the connection identifier analysis means.]

29. (Amended) A data communication network system, comprising:

networks including at least one virtual connection oriented network;

a transmission node provided in each network configured to transmit [for transmitting] datagrams such that datagrams with an identical quality of service are transmitted through at least one specific virtual connection; and

a router device configured to connect [for connecting] at least two of the networks, the router device including[:],

at least one network interface connected with said at least two of the networks[:],

a memory configured to store [for storing] a correspondence between a virtual connection identifier and a quality of service[:],

a connection identifier analysis unit configured to determine [means for determining] a quality of service for a datagram entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection[:],

a scheduler configured to apply [means for applying] a priority control for datagrams to be transferred by the router device according to the quality of service determined by the connection identifier analysis means[:], and

a transfer unit configured to transfer [means for transferring] the datagram to which the priority control is applied by the scheduler means.

[30. A data communication network system, comprising:

networks including at least one ATM network;

a transmission node provided in each network for transmitting datagrams such that datagrams destined to an identical destination are transmitted through at least one specific virtual connection; and

41

a router device for connecting at least two of the networks, and for transferring AAL frames from an ATM network through network interfaces connected with the networks, each network interface connected with said at least one ATM network including reception means for receiving ATM cells from an ATM network and assembling an AAL frame from the received ATM cells, and transmission means for forming ATM cells from an AAL frame and transmitting the formed ATM cells to an ATM network, the router device including:

a memory for storing a correspondence between a virtual connection identifier and a transfer target network interface;

connection identifier analysis means for determining a transfer target network interface for an AAL frame assembled from ATM cells entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection;

processing means for determining a transfer target network interface for the AAL frame by assembling datagram from the AAL frame and analyzing the assembled datagram, when the memory does not store the transfer target network interface in correspondence to the virtual connection identifier of the virtual connection; and

transfer means for transferring the AAL frame to the transfer target network interface determined by one of the connection identifier analysis means and the processing means.

31. A data communication network system, comprising:

networks including at least one ATM network;

a transmission node provided in each network for transmitting datagrams such that datagrams destined to an identical destination are transmitted through at least one specific virtual connection; and

a router device for connecting at least two of the networks including an ATM network; and

an ATM network interface card device for interfacing an ATM network and a bus for connecting other network interfaces connected with other networks, the ATM network interface card device including:

reception means for receiving ATM cells from the ATM network and assembling an AAL frame from the received ATM cells;

a memory for storing a correspondence between a virtual connection identifier and a transfer target network interface;

connection identifier analysis means for determining a transfer target network interface

42

for an AAL frame assembled from ATM cells entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection; and

transfer means for transferring the AAL frame through the bus to the transfer target network interface determined by the connection identifier analysis means.]

32. (Amended) A data communication network system, comprising:

networks including at least one virtual connection oriented network;

a transmission node provided in each network configured to transmit [for transmitting] datagrams such that datagrams of an identical protocol type and/or version are transmitted through at least one specific virtual connection; and

a router device configured to connect [for connecting] at least two of the networks, the router device including[:].

at least one network interface connected with said at least two of the networks[:].

a memory configured to store [for storing] a correspondence between a virtual connection identifier and a protocol type information indicating a type and/or a version of a protocol[:].

a connection identifier analysis unit configured to determine [means for determining] a protocol type information for a datagram entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection[:].

a datagram analysis unit configured to determine [means for determining] a transfer target network interface/next hop network layer address for the datagram according to a datagram content of the datagram, the datagram analysis unit [means] having a plurality of processors in correspondence to different protocols, and the datagram is entered into one of said plurality of processors which corresponds to a protocol of a type and/or a version indicated by the protocol type information determined by the connection identifier analysis unit [means:], and

a transfer unit configured to transfer [means for transferring] the datagram to the transfer target network interface/next hop network layer address determined by the datagram analysis unit [means:].

[33. A transmission node device for transmitting datagrams to a router device, comprising:

a memory for storing a correspondence between a destination and an output virtual

43

connection identifier, the correspondence being known to the router device;

datagram analysis means for determining an output virtual connection identifier for a datagram to be transmitted, by referring to the memory according to a destination of the datagram; and

transmission means for transmitting the datagram to a virtual connection having the output virtual connection identifier determined by the datagram analysis means, such that datagrams destined to an identical destination are transmitted through at least one specific virtual connection.]

34. A transmission node device for transmitting datagrams to a router device, comprising:

a memory configured to store [for storing] a correspondence between a quality of service specifying information indicating a quality of service and an output virtual connection identifier, the correspondence being known to the router device;

a datagram analysis unit configured to determine [means for determining] an output virtual connection identifier for a datagram to be transmitted, by referring to the memory according to a quality of service specifying information of the datagram; and

a transmission unit configured to transfer [means for transmitting] the datagram to a virtual connection having a virtual connection identifier identical to the output virtual connection identifier determined by the datagram analysis unit [means], such that datagrams with an identical quality of service specifying information are transmitted through at least one specific virtual connection.

35. A transmission node device for transmitting datagrams to a router device, comprising:

a memory configured to store [for storing] a correspondence between a protocol type information indicating a type and/or a version of a protocol and an output virtual connection identifier, the correspondence being known to the router device;

a datagram analysis unit configured to determine [means for determining] an output virtual connection identifier for a datagram to be transmitted, by referring to the memory according to a type and/or a version of a protocol of the datagram; and

a transmission unit configured to transmit [means for transmitting] the datagram to a virtual connection having a virtual connection identifier identical to the output virtual connection identifier determined by the datagram analysis unit [means], such that

44

datagrams of an identical protocol type and/or version are transmitted through at least one specific virtual connection.

[36. A method for transmitting datagrams to a router device, comprising the steps of:

storing in a memory a correspondence between a destination and an output virtual connection identifier, the correspondence being known to the router device;

determining an output virtual connection identifier for a datagram to be transmitted, by referring to the memory according to a destination of the datagram; and

transmitting the datagram to a virtual connection having the output virtual connection identifier determined by the determining step, such that datagrams destined to an identical destination are transmitted through at least one specific virtual connection.]

37. A method for transmitting datagrams to a router device, comprising the steps of:

storing in a memory a correspondence between a quality of service specifying information indicating a quality of service and an output virtual connection identifier, the correspondence being known to the router device;

determining an output virtual connection identifier for a datagram to be transmitted, by referring to the memory according to a quality of service specifying information of the datagram; and

transmitting the datagram to a virtual connection having a virtual connection identifier identical to the output virtual connection identifier determined by the determining step, such that datagrams with an identical quality of service specifying information are transmitted through at least one specific virtual connection.

38. A method for transmitting datagrams to a router device, comprising the steps of:

storing in a memory a correspondence between a protocol type information indicating a type and/or a version of a protocol and an output virtual connection identifier, the correspondence being known to the router device;

determining an output virtual connection identifier for a datagram to be transmitted, by referring to the memory according to a type and/or a version of a protocol of the datagram; and

transmitting the datagram to a virtual connection having a virtual connection identifier identical to the output virtual connection identifier determined by the determining step, such that datagrams of an

45

identical protocol type and/or version are transmitted through at least one specific virtual connection.

39. (New) A router device for transferring datagrams among networks comprising:

- network interfaces connected with networks including at least one virtual connection oriented network and at least one non-virtual connection oriented network;
- a memory configured to store a correspondence between a virtual connection identifier and a transfer target network interface, and also to store a correspondence between the virtual connection identifier and a network layer address;

- a first connection identifier analysis unit configured to determine a transfer target network interface for a datagram entered from a virtual connection, by referring to the memory according to a virtual connection identifier of the virtual connection;

- a second connection identifier analysis unit configured to determine a transfer target network layer address for the datagram entered from the virtual connection, by referring to the memory according to the virtual connection identifier of the virtual connection;

- a first transfer unit configured to transfer the datagram to the transfer target network interface connected with another virtual connection oriented network, when the transfer target network interface is determined by the first connection identifier analysis unit; and

- a second transfer unit configured to transfer the datagram to the transfer target network interface connected with the at least one non-virtual connection oriented network toward the transfer target network layer address, when the transfer target network layer address is determined by the second connection identifier analysis unit.

40. (New) A router device according to claim 39, wherein:

- the transfer target network interface is configured to transmit the datagram towards a datalink address determined using the transfer target network layer address.

41. (New) A router device according to claim 39, wherein:

- a transfer target of the datagram is determined without referring to the datagram content.

42. (New) A method for transferring datagrams among networks, using a router device having network interfaces connected with networks including at least one virtual connection oriented network and at least one non-virtual connection oriented network, the method comprising the steps of:

46

- storing a correspondence between a virtual connection identifier and a transfer target network interface in a memory provided at the router device, and also storing a correspondence between the virtual connection identifier and a network layer address;

- first determining a transfer target network interface for a datagram entered from a virtual connection at the router device, by referring to the memory according to a virtual connection identifier of the virtual connection;

- second determining a transfer target network layer address for the datagram entered from the virtual connection, by referring to the memory according to the virtual connection identifier of the virtual connection;

- first transferring the datagram to the transfer target network interface connected with another virtual connection oriented network, when the transfer target network interface is determined by the first determining step; and

- second transferring the datagram to the transfer target network interface connected with the at least one non-virtual connection oriented network toward the transfer target network layer address, when the transfer target network layer address is determined by the second determining step.

43. (New) A method according to claim 42, wherein:

- the step of second transferring transmits the datagrams from the transfer target network interface toward a datalink address determined using the transfer target network layer address.

44. (New) A method according to claim 42, wherein:

- the step of determining the transfer target network layer address is performed without referring to the datagram content.

45. (New) A method for transferring datagrams among networks, using at least two router devices having network interfaces connected with networks including at least one virtual connection oriented network, the method comprising the steps of:

- storing a correspondence between a virtual connection identifier and a transfer target network interface in a memory provided at a router device;

- determining a transfer target network interface for a datagram entered from a virtual connection at the router device, by referring to the memory according to a virtual connection identifier of the virtual connection on which the datagram is received;

- transferring the datagram to the transfer target network interface determined by the determining step;

47

first transmitting the datagram along with another virtual connection identifier from the transfer target network interface over a second virtual connection to another router device;

receiving the datagram, at said another router device, from the transfer target network interface at the router device over the second virtual connection;

removing said another virtual connection identifier from the datagram at said another router device; and

second transmitting said datagram, at said another router device, away from said another router device without said another virtual connection identifier, and without adding another virtual connection identifier.

46. (New) A method according to claim 45, wherein said step of second transmitting said datagram away from said another router device comprises transmitting said datagram over a non-virtual connection oriented network.

47. (New) A method according to claim 46, wherein said step of second transmitting said datagram way from said another router device comprises transmitting said datagram to a location using a network layer address associated with the datagram.

48. (New) A method according to claim 45, wherein said step of second transmitting said datagram way from said another router device comprises transmitting said datagram to a location using a network layer address associated with the datagram.

49. (New) A method according to claim 48, wherein said step of second transmitting said datagram way from said another router device comprises transmitting said datagram without referring to the datagram content to a location using a network layer address associated with the datagram.

50. (New) A method for transferring datagrams among networks, using a router device having network interfaces connected with networks including at least one virtual connection oriented network, the method comprising the steps of:

storing a correspondence between a virtual connection identifier and a transfer target network interface in a memory provided at the router device;

determining a transfer target network interface for a datagram entered from a virtual connection at the router device, by referring to the memory according to a virtual connection identifier of the virtual connection on which the datagram is received;

48

transferring the datagram to the transfer target network interface determined by the determining step; and

transmitting said datagram from the router device without said virtual connection identifier, and without adding another virtual connection identifier.

51. (New) A plurality of router devices for transferring datagrams among networks, comprising:

a first router device including,

a first set of network interfaces connected to at least a first virtual connection oriented network,

a first memory configured to store a first correspondence between a first input virtual connection identifier and a first transfer target network interface,

a first connection identifier analysis unit configured to determine the first transfer target network interface for a first datagram entered from a first input virtual connection, by referring to the first memory according to the first input virtual connection identifier of the first virtual connection, and

a first transfer unit configured to transfer the first datagram to the first transfer target network interface determined by the first connection identifier analysis unit; and

a second router device including,

a second set of network interfaces connected to at least a second virtual connection oriented network,

a second memory configured to store a second correspondence between a second input virtual connection identifier and a next hop layer address to be used in a case where the second set of network interfaces is connected to at least a non-virtual connection oriented network,

a second connection identifier analysis unit configured to determine a second transfer target network interface for a second datagram entered from a second input virtual connection, by referring to the second memory according to the second input virtual connection identifier of the second virtual connection, and

a second transfer unit configured to transfer the second datagram to the second transfer target network interface determined by the second connection identifier analysis unit.

52. (New) A method for transferring datagrams among networks, using a first router device and a second router device having network interfaces connected with networks including at least one virtual connection oriented network, the method comprising the steps of:

49

storing a correspondence between a first virtual connection identifier and a first transfer target network interface in a memory provided at the first router device;

determining a first transfer target network interface for a datagram entered from a first virtual connection at the first router, by referring to the memory provided at the first router device according to a virtual connection identifier of the first virtual connection;

transferring the datagram entered from the first virtual connection to the first transfer target network interface determined by the determining step;

storing a correspondence between a second virtual connection identifier and a second transfer target network interface in a memory provided at the second router device, said second transfer target network interface being connected to a next hop network layer address to be used in a case where the network interfaces of the second router is connected to at least a non-virtual connection oriented network;

determining a second transfer target network interface for a datagram entered from a second virtual connection at the second router, by referring to the memory provided at the second router device according to a virtual connection identifier of the second virtual connection; and

transferring the datagram entered at the second virtual connection to the second transfer target network interface determined by the determining step.

53. (New) A plurality of router devices for transferring datagrams among networks, comprising:

a first router device including,
a first set of network interfaces connected to at least a first virtual connection oriented network,

a first memory configured to store a first correspondence between a first input virtual connection identifier and a first output virtual connection identifier,

a first connection identifier analysis unit configured to determine the first transfer target network interface for a first datagram entered from a first input virtual connection, by referring to the first memory according to the

50

first input virtual connection identifier of the first virtual connection, and

a first transfer unit configured to transfer the first datagram to the first transfer target network interface determined by the first connection identifier analysis unit; and

a second router device including,
a second set of network interfaces connected to at least a second virtual connection oriented network,

a second memory configured to store a second correspondence between a second input virtual connection identifier, a second transfer target network interface, and a second output virtual connection identifier,

a second connection identifier analysis unit configured to determine the second transfer target network interface for a second datagram entered from a second input virtual connection, by referring to the second memory according to the second input virtual connection identifier of the second virtual connection, and

a second transfer unit configured to transfer the second datagram to the second transfer target network interface determined by the second connection identifier analysis unit without attaching said second output virtual connection identifier to said datagram.

54. (New) A method for transferring datagrams among networks, using a first router device and a second router device having network interfaces connected with networks including at least one virtual connection oriented network, the method comprising the steps of:

storing a correspondence between a first virtual connection identifier and a first transfer target network interface in a memory provided at the first router device;

determining a first transfer target network interface for a datagram entered from a first virtual connection at the first router, by referring to the memory provided at the first router device according to a virtual connection identifier of the first virtual connection;

transferring the datagram entered from the first virtual connection to the first transfer target network interface determined by the determining step;

storing a correspondence between a second virtual connection identifier and a second transfer target network interface in a memory provided at the second router device;

51

determining a second transfer target network interface for a datagram entered from a second virtual connection at the second router, by referring to the memory provided at the second router device according to a virtual connection identifier of the second virtual connection; and

transferring the datagram entered at the second virtual connection to the second transfer target network interface determined by the determining step without attaching an output virtual connection identifier to said datagram.